

THE IMPACTS OF TRADEMARKS AND PATENTS ON LABOUR PRODUCTIVITY IN THE KNOWLEDGE-INTENSIVE BUSINESS SERVICE SECTORS

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Abstract

The economic and social roles of Intellectual Property Rights (IPRs) are among the most puzzling mysteries of the current literature. The British Industrial Revolution initiate the era of a sustained economic growth all over the world and established institutions that have important effects even in the modern ages. This paper focuses on the determinants of labour productivity growth performance (in terms of the change in output per capita over time) of several OECD countries. In this conceptual framework several IPRs, such as trademarks and patents, are first analyzed in the context of knowledge intensive (business) service (hereafter KI(B)S) branches. In order to support both theoretical deductions and empirical findings of the literature a dynamic regression model is tested to clarify whether a valid relationship exists between output per capita and the number of patents and trademarks in the long run. The results of the regression analysis show that an increase in the number of trademarks and patents might correlate negatively with labour productivity growth in KI(B)S industries between 1995 and 2011. Hence, this conclusion also highlights that some institutional reforms are needed to change the current intellectual property right systems.

Keywords: sectoral approach, labour productivity, KI(B)S, intellectual property rights

JEL Classification: O34, I23, D23

Introduction

One of the important events in the economic history of output growth was the Industrial Revolution in Britain. At the beginning of the 18th century there occurred a rapid and sustained technology driven growth in per capita income that spread all over the world (e.g. Allen, 2006; Harley, 2003). The long term effects of this phenomenon still feature among the main ‘mysteries’ of economics. The literature discusses several possible reasons for this

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kind of growth. Coase (1960) revealed the role of high one-time transaction costs of inventions. Investment into innovations takes place only if it promises appropriate profit expectations. In other words, this is a prerequisite of efficient capital allocation in inventions. For these appropriated profit expectations, to be realistic it is necessary that the results of the inventions should not be easy to copy. Providing legal protection against imitation and copying is the main role of Intellectual Property Rights (IPRs) because they "... grant investors monopoly power in order to allow them to obtain a return from their inventions" (Jones, 2001, p.86).

Although, the academic literature has long claimed that the presence of strong intellectual property rights historically leads to greater economic growth, in the last few decades more attention has been paid to the concept of coercing properties (Weingast, 1995; Djankov et al., 2002). The theories of the new institutional economics deal with levels of institutions and underline the importance of the legal environment of markets (Williamson, 2000; Boettke, Coyne and Leeson, 2008). They argued that the core "informal" institutions, such as norms, culture etc. are entirely embodied in the stickiest "formal" institutions of economies. The securities of these institutions (i.e. property rights, rule of law etc.) have been incrementally altered in the framework of legal systems over time, triggered by spontaneous and endogenous market processes in order to influence the degree to which ideas can be excluded. Meanwhile, Boldrin and Levine (2002) argued that new concepts should be protected and available for sale, and also that "intellectual property" should mean not only the right to own and sell, but also the right to regulate its use. These institutions generate non-competitive markets that – according to the principles of economics – are expected to be socially and economically inefficient; hence, they might be better defined in terms of "intellectual monopolies".

The study focuses on two sub-sectors that are often differentiated by the innovation literature. Knowledge-intensive service (KIS) activities (as well as the goods they offer) include a high knowledge component, which is one of factors of production. Meanwhile, the knowledge-intensive business services KI(B)S, as a subcategory of KIS, was described by Strambach (2008) as a process of cumulative learning, which arises from *in-depth interactions* between supplier and customer, and an *activity of consulting*, i.e. a process of problem solving to adopt expert knowledge to the needs of clients.

In order to harmonize with the new theoretical challenges of technological development and international classifications for products and services of different industries a revision of statistical classification processes was initiated and accepted in 2008. Schnable and Zenker (2013) later presented the KI(B)S classification of NACE (Statistical classification of economic activities in the European Community) Rev. 2. Table no. 1 shows KI(B)S subgroups related to information and communication, as well as professional, scientific and technical activities. The first section refers to activity groups of production and distribution of information, cultural products and the transition processes of communication and information technology, namely "information technology" (division 62), "information service" (division 63) and other "management consultancy" activities (division 70). The next section relates to those activities that require a high degree of training and that provide users with special knowledge and skills, including fundamental elements of KI(B)S, along with divisions (69, 71, 72 and 73), referring to legal and accounting, head offices, management consultancy, architectural and engineering, scientific research and development, advertising and market research activities (EUROSTAT, 2008, p.49).

Table no. 1. Classification of KI(B)S activities in NACE Rev 2.

KIBS classification NACE Rev. 2.	Description of division
Division (62)	Computer programming, consultancy and related activities
Division (63)	Information service activities
Division (69)	Legal and accounting activities
Division (70)	Activities of head offices; management consultancy activities
Division (71)	Architectural and engineering activities; technical testing and analysis
Division (72)	Scientific research and development
Division (73)	Advertising and market research

Source: Schnabl and Zenker, 2013, p. 6.

For a long time, researchers and policymakers have been more interested in high-tech manufacturing industries than knowledge-intensive business sectors. Although previous academic research has concentrated on the technological innovation of manufacturing adapters, non-technological service innovations should also have been considered in detail (Shricke, Stahlecker and Zenker, 2012). Accordingly, the European Commission (EC) stated that the economic importance of KI(B)S depends more on productive improvements than on manufacturing (EC, 2007, p.7). An important feature of these kinds of services is the constant need for adaptation to clients and to the business context. Firms that mainly build their business on KI(B)S activities (hereafter KI(B)S firms) are frequently involved in specific fields of innovation, such as customization of new software, ways of delivering services, organizational types or marketing procedures (Baines et al., 2009). KI(B)S innovations are characterized by the great importance of human capital, the simultaneity of production and consumption, and a strong connectivity to customers and the intangible environment (Tether and Hipp, 2000). The nature of innovations within KI(B)S are often project oriented, interactive and embodied in the knowledge of people, as well as being embedded in IC networks (Strambach, 2008).

Essentially, innovative KI(B)S firms are challenged by the fact that it is very difficult to protect their services from imitation (Gallouj and Weinstein, 1997). Howells (2001) also emphasized that the results of IPR protection mechanisms in KI(B) services are different from those in manufacturing. The most commonly supported IPRs that seem to be relevant for KI(B)S sectors are trademarks and patents. A trademark is a sign (word, phrase etc.) capable of distinguishing the goods or services of one enterprise from another to protect a company brand. However, these forms of protection are not necessarily connected to innovative products. For example new names are often registered as product innovation. A patent is an exclusive right granted by an authority to the inventor of products or services for a limited period of time in exchange for a detailed public disclosure of an invention (WIPO, 2008, p.17).

Researchers are commonly interested in examining the impacts of these institutions on economic performance. The remainder of this paper is structured as follows. In the next section we describe the datasets and the methods applied to determine the main factors of the output per capita growth performance of KI(B)S. Because of the limited measurement data relating to IPRs, the econometric evidences for the impacts on productivity in KIB(S) industries has, as yet, hardly been presented in the literature. The results of our dynamic regression models based on a Cobb-Douglas production function, with cross-industry panel data from various OECD countries, can demonstrate how trademarks and patents affect productivity growth in the long run.

Our research questions are the following:

- What are the contributions of KI(B)S industries to employment and output at a regional level?
- What are the recent tendencies in trademark and patent applications in the OECD countries?
- How is productivity related to trademarks and patents?

At the end of this paper we draw conclusions and policy suggestions in order to support the better productivity performance of KI(B)S industries, highlighting the importance of changes in current property protection systems.

1. Employment and output contributions of KI(B)S branches

In 2003 the European Union (EU) supported the KLEMS project to develop a unique database, in which a limited set of variables, such as output, employment, capital formation etc. are available at industry level for various OECD countries from 1970 onwards. The latest (March) release of this database provides information up to 2011 in 56 different industries (KLEMS, 2015). The industries are separated by an international standard of indicators of activities for industry and services, based on ISIC (International Standard Industrial Classification of All Economic Activities) Rev. 3. All in all, 13 OECD countries - Austria (AUR), Belgium (BEL), Czech Republic (CZE), Denmark (DEN), Finland (FIN), France (FRA), Germany (GER), Hungary (HUN), Italy (ITA), Netherland (NED), Norway (NOR), Slovenia (SLO), Sweden (SWE) - are accessible for researchers wishing to explore the relationship between IPRs and GDP per capita in different KI(B)S industries.

In our estimations we applied the given time series data of gross value added (GVA) in constant (1995) prices. GVA is used in economics as the value of goods and services produced in an industry and it is equivalent to output less intermediate consumptions. The numbers of people engaged are calculated, in order to estimate the employment performance in each KI(B)S industry.

Figure no. 1 shows the percentage value (%) of total employment in 2008 and 2013, and Figure no. 2 represents the output growth rate during this period in KI(B)S. Employment was increased slightly and was greater in 2013 than in 2008 in all examined OECD countries with the sole exception of Italy. This favourable employment performance over the last few years seems to be mainly demand-driven, as Dachs (2009) claimed, and only specialized expertise can solve the multiple challenges of globalized economies. One feature of this expert knowledge is that it is not always required at the same time and at the same level. This might mean that outsourcing activities can be provided more efficiently by outsiders, such as legal service companies, marketing or travel agencies etc.

Meanwhile, employment in KI(B)S is mainly high in central and northern Europe, while employment ratios are lower in the southern regions (Schricke, Stahlecker and Zenker, 2012). Consequently high-tech services are mostly concentrated in the European capitals, as well as in other cities. On the contrary, knowledge-intensive market services are highly distinctive of central and northern European regions, while knowledge-intensive financial services are located in the main financial centres (London, Frankfurt etc.).

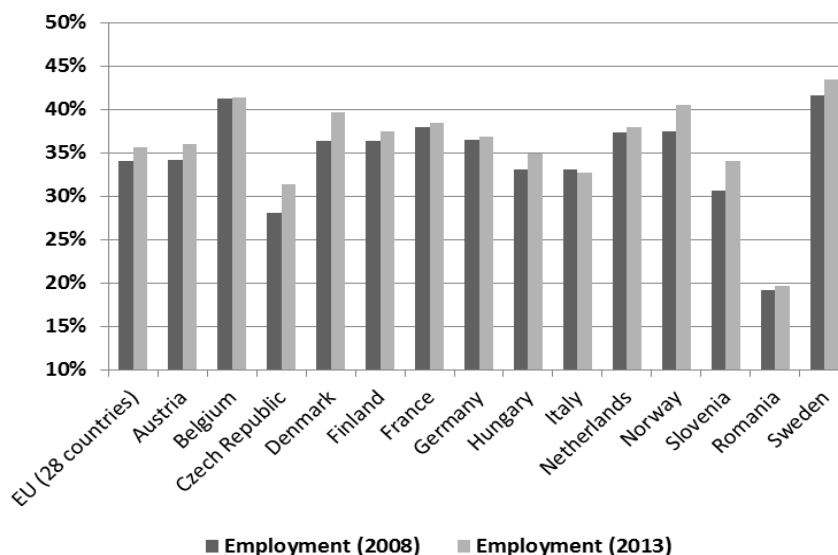


Figure no. 1: % of total employment in KI(B)S industries

Source: calculations based on EUROSTAT, 2015

Figure no. 2 indicates that output growth varies substantially across countries. The average rate of growth is more than 4% in the majority of KI(B)S industries. In the KI(B)S industries of Germany, France and the Scandinavian region a much greater employment contribution and in parallel a much larger growth of output occurred, compared to the OECD-13 averages in the period 2008-2013.

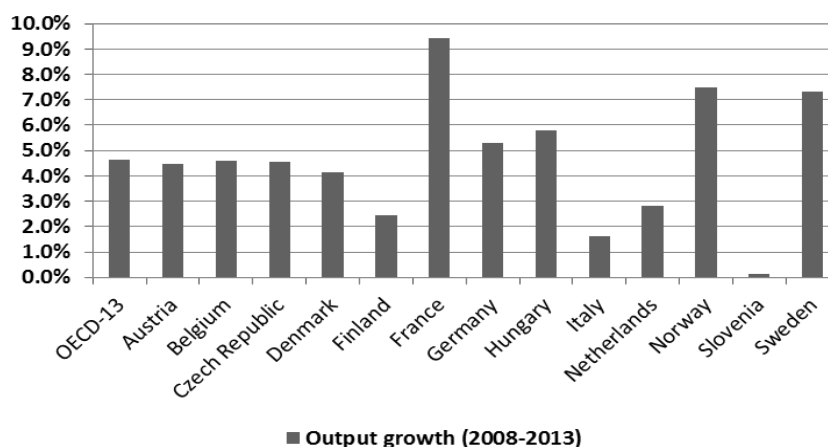


Figure no. 2: Output growth (%) in KI(B)S industries for selected OECD-13 countries

Source: calculations based on KLEMS, 2015

2. Trends in knowledge-intensive trademark and patent applications

In spite of the challenges involved in changes in IPRs over time, researchers generally examine how IPRs might have an impact on productivity growth in the long run. The required country specific datasets are taken from the Statistics Database of the World Intellectual Property Organization (WIPO), in which trademarks are accumulated through the Madrid and Hague registration systems. According to the international Nice Classification (NCL), trademark applications are divided into 45 distinct classes for goods and services. The 42nd Class contains the total number of trademarks registered directly by the European Patent Office (EPO) related to the “scientific and technological services, design and development of computers’ hardware and software” applications (WIPO, 2008). In order to check the robustness of our dynamic model specifications we will also examine the high-tech patent applications in knowledge-intensive branches (EC, 2015).

Four of the top 10 classes of trademarks are related to business services and the 42th Class occupied the 7th position with 4% of total trademark applications up to 2013 (WIPO, 2015). However, the largest annual total number of trademarks was registered in 2000. After this year the strong worldwide growth in applications stopped. Due to the financial crisis in 2007, trademark applications do also seem to be following a persistent and substantially descending pattern (see Figure no. 3).

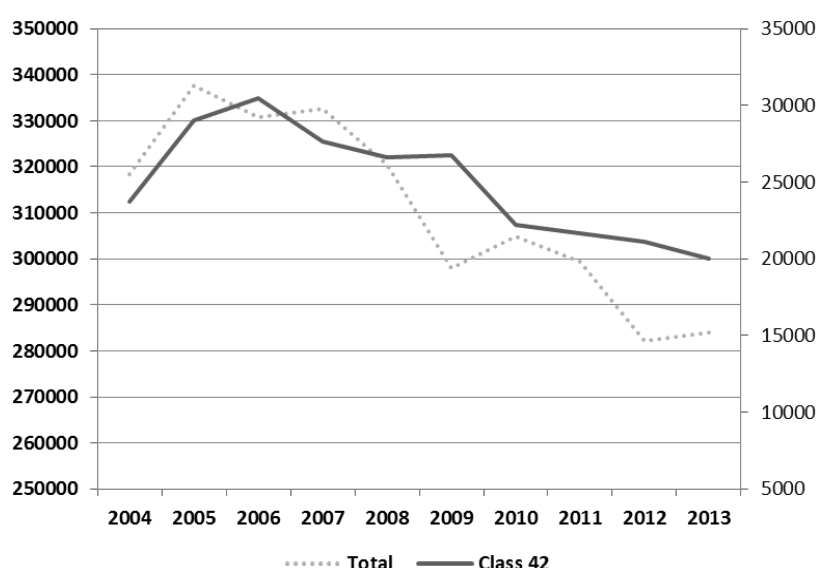


Figure no. 3: Number of trademark applications for selected OECD-13 countries

Source: calculations based on WIPO, 2015

Since 2010, a steadily decreasing trend can also be observed in these applications. Although, the average share of total high-tech patent applications rose from about 57% in the early 1990s to 63% in 2012, some OECD countries suffered an extensive decline in the number of patents in high-tech areas (Frietsch et al., 2015).

Although, France was able to increase the high-tech patent applications to the EPO up to 2006 and the figure remained mostly stable until 2010, this trend later changed in line with other OECD members, as shown in Figure no. 4. Meanwhile, in Germany – which is one of the most innovation-oriented countries – the decrease is especially visible. In 2013, there were more than 2200 fewer German high-tech patents, as in 2004. Thus, the total EU-28 patent applications to the EPO in high technology fields seemed to halve during the 2004-2012 period. All in all, both trademark and patent applications related to the KI(B)S clearly decreased after 2010, and this negative tendency seems to be continuing today.

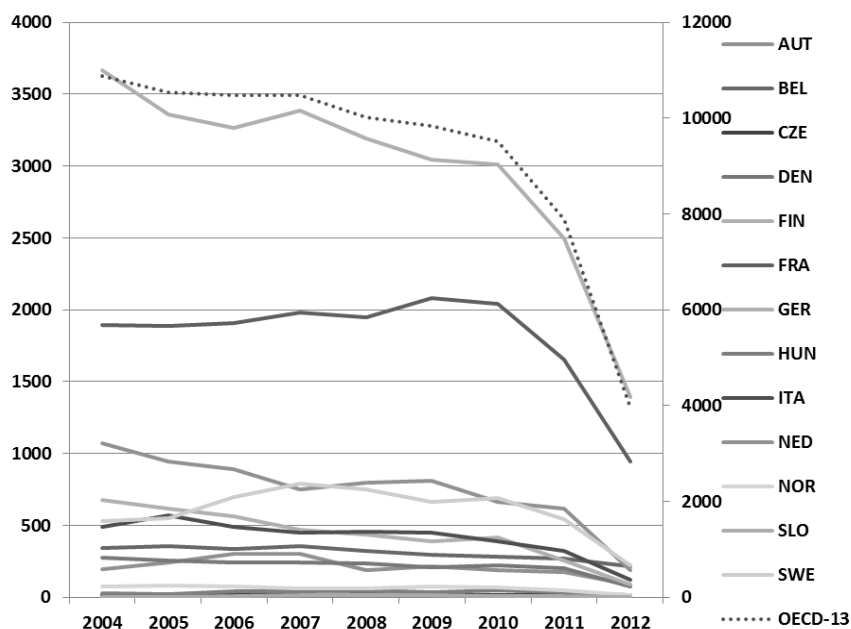


Figure no. 4: Number of high-tech patent applications for selected OECD-13 countries
Source: calculations based on WIPO, 2015

3. Analyzing the impact of trademarks and patents on productivity through a dynamic approach

Although scholars have recently become interested in examining the effects of IPRs in terms of how they might influence productivity, no clear consensus has yet emerged, and several unanswered problems still remained. Furthermore, there are still disagreements about whether strengthening IPRs enhances or decreases the international competitiveness of industries in the long run. Park (2003) focused on manufacturing industries in OECD countries and found that both labour productivity and R&D expenditure increased with IPRs. Hu and Png (2012) also demonstrated that more patent-intensive industries responded to stronger patent laws, which resulted in increased GDP per capita. However, these results concentrated on the protection of technological innovation in manufacturing sectors, and the role of IPRs in non-technological innovation oriented or KI(B)S industries also needs further examination in terms of trademarks and patents. We can also state that, in

accordance with the changing legal and economic environment of the 21st century, the production is expected to vary across industries. Based upon the 3rd research question and the empirical findings of the literature discussed above, the following hypothesis is formed:

H1: The number of trademark and patent applications correlates positively with labour productivity growth in KI(B)S industries.

According to the theoretical background of our research it must be noted that traditional neo-classical economic models did not respect the role of institutions. In the 1950s Solow (1956) was the first to argue that it was not only changes in the quantities of physical and human capital accumulation that affected output growth. Hence, there must be an additional "residual" effect on growth, which is often termed in the literature as Total Factor Productivity (TFP). Caselli (2005) claimed technology as a combination of machines and equipment of a certain type and workers who have the skills necessary to use them, and technological progress, in turn, means their continuous improvement. In this context, TFP may also include complex factors that cannot be classified into the "traditional" (capital) factors that determine production, either stemming from improving technological quality, economies of scale or management skills, or bearing on such external effects of production as innovation, market competition and regulation etc. The impact of TFP on output can also be examined from the aspect of institutional economics. Consequently, the institutions are worthy candidates to explain a large element of these unexplained growth effects, and thus they were soon introduced into the new theories of economic growth. In this context, analysing the impact of IPRs on productivity in KI(B)S industries can contribute to understand further economic, social and political interactions in sectoral approaches.

Our estimations are based on a Cobb-Douglas production function (1), in which income at time t can be written as described by Mankiw, Romer and Weil (1992):

$$Y_t = K_t^\alpha (A_t L_t)^{1-\alpha-\beta} \quad (1)$$

where the notation is the standard:

Y – represents the output,

K – is the physical capital and

L – stands for the labour accumulation, while

$(1-\alpha-\beta)$ – α and β are the output elasticities of capital and labour, respectively. These values are constants determined by the available technology.

A – is Total Factor Productivity (TFP).

In our model TFP is assumed to be a function of institutional elements. Hence, the IPRs might impact on productivity by affecting the technical efficiency of production as the primary engine of growth. So, substitute A to the following Equation (2):

$$A_t = A(IPR)_t = aIPR_t^\gamma \quad (2)$$

where

IPR – denotes intellectual property rights and

γ – is the elasticity of technical efficiency with respect to the level of IPR.

Thus, divide each side of Equation (1) with L :

$$y_t = k_t^\alpha (IPR_t)^{\gamma(1-\alpha-\beta)} \quad (3)$$

where

$y = Y/L$, labour productivity;

$k = K/L$, the inputs are expressed in terms of efficiency labour units.

The equation of motion is the following (4):

$$\dot{k} = i_k + (n + g + \delta)k \quad (4)$$

where

g – growth of technical efficiency,

n – growth rate of labour force,

i_k – investment rate,

δ – geometric rate of depreciation.

Let

$$i_k = s_k y \quad (5)$$

where

s_k – represents the respective savings rate from output.

Thus, in the steady state:

$$k^* = \frac{s_k y}{(n + g + \delta)} \quad (6)$$

The next step is to substitute Equation (5) and (6) into (3). Taking the logs of both sides, and after rearranging them, the next Equation (7) expresses the steady state level of labour productivity (y^*). Now, the economy tends toward a long run equilibrium, and the extent of economic growth generally affects the rate at which per capita output approaches its steady state value. Consequently, the log income per capita at a given time (t) is equal to the following formula:

$$\ln(y^*)_t = \frac{\alpha}{1-\alpha-\beta} \ln(s_k)_t - \frac{\alpha+\beta}{1-\alpha-\beta} \ln(n+g+\delta)_t + \gamma \ln(IPR) \quad (7)$$

Taking into account new endogenous growth theories dynamic GMM estimations were calculated, developed by Arellano and Bond (1991), to determine how trademarks and patents might have an impact on productivity growth in the long run. Our dynamic models include the lagged dependent variables among the repressors. These model specifications require exceptional instrumentation to employ lagged levels of dependent and predetermined variables, as well as differences between the exogenous variables as instruments.

After taking the first difference of the dependent variable of Equation (7), the following regression formula is tested in each i KI(B)S sector:

$$\Delta \ln y_{it} = \beta_0 + \beta_1 \Delta \ln y_{it-1} + \beta_2 \ln(s_k)_{it} + \beta_3 \ln(n+g+\delta)_{it} + \beta_4 \ln(patent)_{it} + \beta_5 \ln(trdmark)_{it} + e_{it} \quad (8)$$

where

Δvar – variable in first difference,

Δvar_{t-1} – lagged differences of variables,

\ln – in logarithm,

$y_{i,t}$ – ratio of real GVA per capita (labour productivity) of country i for the period t at a constant price (1995),

$y_{i,t-1}$ – lagged productivity growth,

$(n+g+\delta)_{i,t}$ – average growth rate of labour (n) plus a constant (0.05) as in Mankiw, Romer and Weil (1992),

$s_{k,i,t}$ – the share of investment within output is accessible from the Penn World Table (PWT, 2015), as included in Heston, Aten and Summers (2006),

$patent_{i,t}$ – total number of patents (direct and national phase entries) in high-tech industries (EUROSTAT, 2015),

$trdmark_{i,t}$ – total number of trademark applications of 42th Class (direct and via the Madrid system) (WIPO, 2015),

$e_{i,t}$ – error term.

The first lags of the dependent variables were the predetermined instruments in our dynamic model specifications. The estimations are based upon an unbalanced panel data including ($i = 13$) OECD countries and over two periods, 1995-2011 and 2004-2011.

Table no. 2 represents the results of our estimations. Descriptive statistics of the variables used in the regressions are reported also in Table no. 3 and 4. In Table no. 2, the long run impact of trademarks and patents on productivity growth are represented (among other things). In our estimation the two-step GMM estimators are preferred, as Windmeijer (2005) suggests, in order to handle the proposition of downward biased standard errors. In other words, it is not only the examined trademarks and patents which can affect labour productivity, other IPRs, such as utility models, industrial designs etc. might also correlate with output per capita and other dependent variables in the long run. The limited amount or the lack of industrial level IPRs data restricts our models. At the bottom section of Table no. 2 the significant Wald tests suggest that the dynamic specification should be preferred in all (1)-(4) models. Thus, the significant AR(1) tests, derived by Arellano and Bond (1991), indicate the lack of autocorrelation in the first differenced errors. According to the Sargan tests, restricted later by Hansen (1982), the null-hypothesis of over-identifying restrictions' validity can be rejected as well.

**Table no. 2: Results of dynamic panel regressions of Equation (8)
in KI(B)S sectors for OECD-13 countries**

Dependent variable: $\ln(y)_{it}$				
Independent variables	(1)	(2)	(3)	(4)
constant	-0.662 (-11.25)***	-0.392 (-2.97)***	-0.845 (-6.72)***	-0.605 (-5.28)***
$\ln(y)_{it-1}$	0.053 (7.13)***	0.042 (2.84)***	0.415 (4.05)***	0.288 (3.92)***
$\ln(s_k)_{it}$	0.236 (11.59)***	0.181 (5.02)***	0.312 (6.95)***	0.271 (5.78)***
$\ln(n+g+\delta)_{it}$	-0.754 (-11.59)***	-0.751 (-14.31)***	-0.939 (-6.84)***	-0.846 (-13.48)***
$\ln(\text{patent})_{it}$		-0.022 (-3.28)***		-0.029 (-4.54)***
$\ln(\text{trdmark})_{it}$			-0.011 (-1.66)*	-0.004 (-0.93)
Number of Observations	164	164	91	91
Number of Countries	13	13	13	13
Wald test	265.62***	1299.16***	123.22***	371.19***
AR test	(-1.81)*	(-1.80)*	(-2.07)**	(-2.03)**
Sargan test	8.51	5.83	6.81	6.54

Notes: * Heteroscedasticity robust z-statistics are in parentheses. *** significant at 1%, ** 5%, * 10%, respectively. P-values without an index mean that the coefficient is not significant even at the 10% level.

Source: estimations based on EUROSTAT, 2015; KLEMS, 2015; PWT, 2015; WIPO, 2015

Table no. 3: Descriptive statistics of panel regressions in KI(B)S sectors

Variables	Mean	Std. Dev.	Min	Max
$\Delta \ln(\text{GVA})_{it}$	0.004	0.041	-0.086	0.156
$\Delta \ln(\text{GVA})_{it-1}$	-0.001	0.472	-0.166	0.156
$\ln(s_k)_{it}$	3.17	0.158	2.786	3.593
$\ln(n_i+g+\delta)_{it}$	0.075	0.031	-0.041	0.156
$\ln(\text{patent})_{it}$	5.31	1.778	1.098	8.202
$\ln(\text{trdmark})_{it}$	6.966	1.178	4.33	9.516

Source: estimations based on EUROSTAT, 2015; PWT, 2015; WIPO, 2015

Table no. 4: The correlation matrix of the dependent variables of Equation (8)

Variables	$\Delta \ln(\text{GVA})_{it-1}$	$\ln(s_k)_{it}$	$\ln(n_i+g+\delta)_{it}$	$\ln(\text{patent})_{it}$	$\ln(\text{trdmark})_{it}$
$\Delta \ln(\text{GVA})_{it-1}$	1.000				
$\ln(s_k)_{it}$	0.272	1.000			
$\ln(n_i+g+\delta)_{it}$	-0.178	-0.463	1.000		
$\ln(\text{patent})_{it}$	-0.521	-0.643	-0.132	1.000	
$\ln(\text{trdmark})_{it}$	0.556	-0.372	0.319	-0.171	1.000

Source: estimations based on EUROSTAT, 2015; PWT, 2015; WIPO, 2015

The impacts of the lagged GVA per capita (y_{it-1}) are robust in all KI(B)S branches and the share of investment within GDP (s_k), as theoretically expected, has significant positive z-statistics. Meanwhile, according to the growth theories, the employment growth attainment ($n+g+\delta$) is negatively related to per capita output growth in our models. In other words, if continuous time is assumed, the growth in employment may negatively affect productivity growth in both industries. In Table no. 2 we also show a valid representation of the relationship between IPRs and productivity growth in the long run. As our results indicate the effects of patents and trademarks on labour productivity seem not to be large in models (2), (3) and (4). The coefficients are ranged from circa 0.011% to 0.022%. The effect of a 1% increase in the number of patents resulted in a decrease in GDP per capita growth of 0.02 percentage points. Nevertheless, the significant negative (0.01) coefficient reveals that trademarks are controversially correlated with productivity growth in KI(B)S branches. Hence, we can reject our hypothesis (H1) in accordance with the positive effects of the examined IPRs on labour productivity in KI(B)S industries.

These findings are consistent with the results of Park (2003) in that they pointed the negative impact of trademarks on productivity in the manufacturing sectors; however, the direct effects of these intellectual property rights were not significant. Thus, Chen and Puttitanun (2005) have confirmed, through the example of numerous OECD countries, the presence of a U-shaped relationship between IPRs and economic development. All of this indicates that, owing to developing countries' stronger incentives to imitate, the high level of intellectual property rights can stimulate productivity growth inversely. Consequently, up to a certain level, productivity declines in line with the increase in IPRs.

In the descent of intellectual property rights there are additional protections that are not included in the models due to restricted access to data or the lack of a sector-specific nature. Some intangible assets, such as industrial designs or utility models, evidently correlate with the increase in productivity. The validity of our conclusions is limited by the bias caused by the exclusion of these variables.

Conclusions

The main contribution of our research is to provide new empirical evidence from a sample of KI(B)S industries. This paper relies on the determinants of several OECD countries' performance in productivity growth. The knowledge-intensive distribution of total employment and output growth were increasing slightly in the period under examination.

Meanwhile, both trademark and patent applications related to the KI(B)S clearly decreased after 2010 and these negative tendencies seem to continue today. These results query one of the suggestions made by van Cruysen and Hollanders (2008), namely that KI(B)S SMEs should be incentivized to apply IPRs - specifically trademarks – so as to overcome market failures in service innovation. Rubalcaba (2006) argued that protecting innovative services against imitation is complicated. Consequently, the separation of monopolistic market structures can be advantageous to stimulate innovation in KI(B)S (EC, 2009).

Thus, we also examined the long-term effects of intellectual property rights on productivity through dynamic panel regression models. Although IPRs appear to function appropriately in certain industries, evidence on the KI(B)S sectors suggested otherwise. Our results indicated that the changes in trademarks and patents correlated significantly and negatively with productivity growth.

This study was not intended to query the utility of intellectual property rights. The innovation activity providing the root for IPRs is a complex process with a long history of evolution, and the economic effects of them are extremely hard to observe. Although intellectual property rights have been an organic part of the economy for centuries, we cannot trace any widely generalizable conclusions in respect of the social and economic impact of trademarks and patents. Subsequently, institutional reforms are expected to be required in the period to come. One such change would be the adoption of new legislation that would allow third parties, besides the European Patent Office (EPO), to inspect reports on and raise objections against the infringement of patents. However, we agree with Boldrin and Levine (2009) and claim that the immediate elimination of existing property systems is not recommended for the sake of the potentially substantial financial losses. Instead, we also proposed a multi-step process. Over the long term, an alternative solution could be the reduction of the validity period of intellectual property rights in specific branches.

A new area for further research has also emerged in this study. Aghion, Alesina and Trebbi (2008) proposed that the increasing level of democracy might enhance labour productivity in developed industries more than in backward ones. This theory has not yet provided a satisfactory answer to questions related to how IPRs and their interactions might influence productivity growth. Our empirical findings have only been able to demonstrate the impacts of patents and trademarks on productivity growth in KI(B)S sectors. Hence, further research in this sectoral approach could be more fruitful.

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